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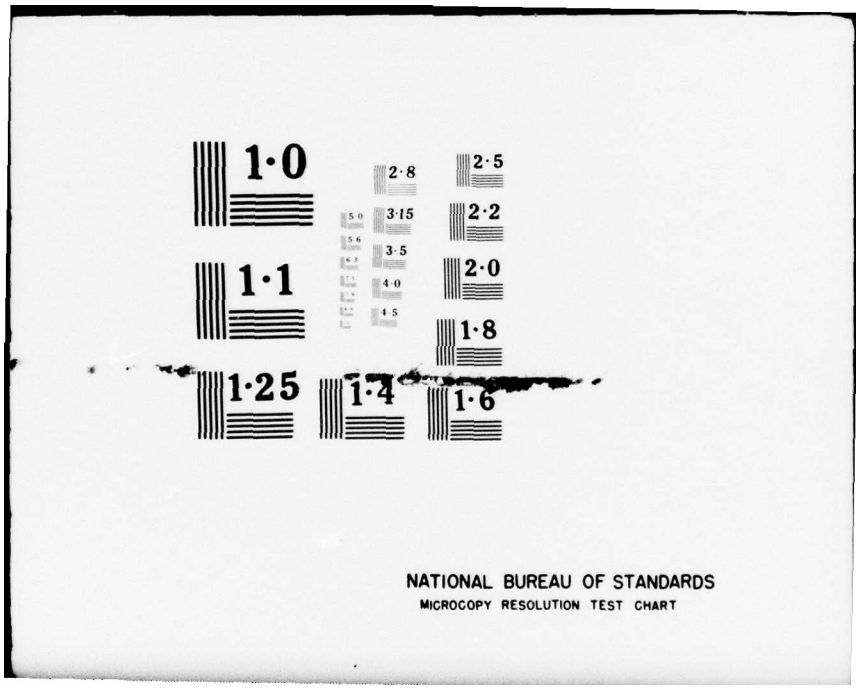
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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE: MAINTAINING TECHNICAL CURRENCY OF PROGRAM OFFICE PERSONNEL

STUDY GOALS: To address the hypotheses

(1) Obsolescence is a problem and the degree of obsolescence is high

(2) Training programs are being pursued by the Services to upgrade their personnel

STUDY REPORT ABSTRACT

Technical obsolescence of scientific and engineering personnel has been indicated as a reality by several studies conducted in civilian industry. The results of this study showed on the other hand that it was not felt to be a significant problem by program managers in the DoD. The study was conducted by mailed questionnaire to program managers in the three Services. In fact, they felt that the technical management capabilities of their people were actually enhanced. Training programs are abundant in the Services but their utilization was low and no clear value could be determined on their worth. The study was an exploratory one and as such opened up many other questions to be pursued.

KEY WORDS: PERSONNEL REQUIREMENTS TECHNICAL TRAINING CIVILIAN PERSONNEL PROJECT MANAGEMENT SCIENTIFIC PERSONNEL

NAME, RANK, SERVICE	CLASS	DATE
Albert A. LoSchiavo, MAJ, USAF	PMC 74-1	May 1974

DEFENSE SYSTEMS MANAGEMENT SCHOOL

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

MAINTAINING TECHNICAL CURRENCY OF PROGRAM OFFICE PERSONNEL

STUDY REPORT
PMC 74-1

Albert A. LoSchiavo
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FORT BELVOIR, VIRGINIA 22060

MAINTAINING TECHNICAL CURRENCY

OF

PROGRAM OFFICE PERSONNEL

An Executive Summary
of a
Study Report
by

Albert A. LoSchiavo
MAJ USAF

May 1974

Defense Systems Management School
Program Management Course
Class 74-1
Fort Belvoir, Virginia 22060

EXECUTIVE SUMMARY

This study is an exploration into the extent and degree of technical obsolescence among program dedicated scientists and engineers within the DoD. The study also looks into the types of programs available for upgrading of these scientists and engineers and their value in preventing obsolescence. This exploratory study is based on a questionnaire which was sent to the program directors of 35 programs within the three Services. Both major and minor programs were surveyed. The response rate was 80%. The study addresses the following specific hypotheses:

(1) "Obsolescence is a problem and the degree of obsolescence is high."

(2) "Training programs are being pursued by the Services to upgrade their personnel."

The results of the study indicates that the {first(?)} just hypothesis is not supportable. From the response received, obsolescence is not a problem. This is in direct contradiction to several other studies performed on scientific and engineering personnel which showed that it was indeed a problem. The resolution to this apparent contradiction lay in the theory of the technical manager. Respondents to the survey felt that their scientific and engineering personnel performed more as

technical managers utilizing a large contractor base of theoreticians and experts. This type of arrangement does not require the technical manager to maintain as detailed a theoretical base as he would require if he were performing the work himself. In fact, the program managers indicated that their technical management capability was actually enhanced rather than obsoleted.

The results of the survey do support the second hypothesis. The results also showed that utilization of these programs is low. This finding is supported by other studies which have shown that engineers do not make use of the programs made available to them for improving their technical expertise.

The major impact of this study is that it should generate further studies which would explore narrower hypotheses in greater depth. A similar questionnaire should be sent to the scientists and engineers of the program offices to determine if their perception of the situation is the same as the program managers. Over the long run, a study could be undertaken using a control group to determine what the effect is on an individual's performance as he moves from program to program, and whether obsolescence created by his long association with the previous program is a factor in his performance.

MAINTAINING TECHNICAL CURRENCY OF PROGRAM OFFICE PERSONNEL

STUDY REPORT

Presented to the Faculty

of the

Defense Systems Management School

in Partial Fulfillment of the

Program Management Course

Class 74-1

by

Albert A. LoSchiavo
MAJ USAF

May 1974

This study represents the views, conclusions, and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School nor the Department of Defense.

ACKNOWLEDGEMENTS

As with most study efforts they are seldom the work of one individual. Thanks is owed to many people. I would like to express my thands to my study advisor, Major George Giacoppe, for his helpful suggestions and his time and interest in the study. Major Lee Jackson's assistance in the drafting and the murder board on the questionnaire were invaluable, as was his list of program managers. Thanks is also owed to Mr. Al Moore, the second reader for his suggestions on the draft. A special note of thanks is for Mrs. Roger Klungle who persevered through my chicken scratches to come up with a readable typewritten copy. But thanks is especially owed to all the program managers who took time out of their busy schedules to answer the questionnaire and make this study possible.

CONTENTS

CHAPTER I

Introduction

As a result of the cost overruns and schedule slippages predominant during the 1960's, program management has become the generally accepted method of conducting business in the DoD. Given the three factors of productivity: materials, money, and manpower, program management has focused primarily on the conservation of the first two: materials and money, but what of the third, manpower? Perhaps program management can conserve numbers of people required to meet the objective of the program, but what of the individual himself? Is dedication to a specific objective over a given time span in his best interests or the long term interest of the DoD?

The purpose of this paper is to provide a preliminary exploration into the effect that program management has on the technical value of scientists and engineers who are dedicated to a program office, and to further explore whether steps are being taken to counteract any adverse effects. Specifically, this study paper will attempt to answer the following questions:

(1) Is technical obsolescence of scientists and engineers in a program office a problem, and if so how significant a problem is it?

(2) Are programs in existence which these scientists and engineers can avail themselves of to maintain technical currency, and what use is made of them?

In a recent article (1:16), the value of a technical man with perhaps forty years of future employment was valued at close to $1 million. Allowing such an individual to lose his capability is a corporate waste.

That technical obsolescence is a reality and the effects of it on the individual were brought home by Alvin Toffler in his best seller Future Shock (2:25-35) in which he points out the accelerative thrust of technology feeding on itself and the generation of journals and articles in the scientific field which keep doubling every fifteen years and mounting at a rate of some 60,000,000 pages a year. A study by Steven B. Zelikoff (3:3-14) analyzed the obsolescence rate of engineering education in different disciplines by analyzing changes in curriculum. He found that in 1950 the 50% obsolescence point was reached in ten years for chemical engineers, and six years for electrical engineers. By 1960, the six years had dropped to 3.5 years. The upshot of this study is that in order to keep our technology accelerating, ever increasing numbers of engineers must be sacrificed or some method found to prolong their value.

This is all well and good but what does it have to do with the program management philosophy? On major programs of any duration scientists and engineers become dedicated to meeting the objective of fielding the equipment. They become tied to the program. By so

doing, they are limiting themselves into a narrow band, and in a sense marching down a tunnel bounded by the project itself. When the project is completed they emerge from this tunnel but are apt to find that they are unfamiliar with their location. Changes have taken place in technology which makes the state of the art of their project outdated, or as the Zelikoff study showed; obsolescence of their discipline has occurred while they were preoccupied by their project. In essence, they are hit with some degree of "future shock", so to speak. In some cases, these engineers and scientists are returning to functional organizations after an absence of several years and will have to re-establish themselves with a handicap of partial obsolescence. It must become increasingly important that both through the organization's and the individual's collective efforts we can decrease the degree of obsolescence and thereby increase the value of the individual to both the organization and himself.

This study involved a literature search that indicated that the area of technical obsolescence had not been satisfactorily explored. Much mention was made of its existence but little of its extent. The exploration in this study was done primarily by questionnaire [Appendix I], sent to the program managers of thirty-five program offices within the three Services. The response rate was 80%.

In Chapter II, the literature found on the subject of technical obsolescence will be discussed and the results of these studies with the questions left unanswered will be laid out. In Chapter III, the method of data collection and analysis will be discussed. Chapter IV proposes the primary hypothesis for testing: Obsolescence is a problem and the degree of obsolescence is high.

Chapter V proposes the secondary hypothesis: Training programs are being pursued by the Services to upgrade personnel. Chapter VI will review the implications arising out of this study as a result of information obtained. Chapter VII will present the conclusions of the study and suggest areas for additional research.

CHAPTER II

Review of Related Research

A literature search on the subjects of technical obsolescence and training programs for its prevention presented sparse results. A DDC search conducted through the Defense Systems Management School library yielded three potentially applicable reports out of sixty read-outs. Upon receipt of these reports, it was discovered that they also were not applicable to the study. A search of the business periodicals index resulted in the aforementioned studies in Chapter I, which were primarily pointing out the existence of this potential problem of obsolescence. A finger walking exercise through the Library of Congress Card Catalog entries of obsolescence, training, engineers, personnel, and management yielded nothing.

It became rapidly apparent that if any work had been done in trying to determine the extent of obsolescence or its impact, it was not within readily available resources. This has led me to conclude that this area of technical obsolescence is primarily a virgin territory for exploration. It was with this void in available literature and the limiting academic time frame that this paper will attempt to lay a basis for opening up explorations in this area.

CHAPTER III

Data Collection and Analysis

The primary method of collecting data for this exploratory effort into the impact of technical obsolescence was by mailed questionnaire. Thirty-five questionnaires were sent to program managers in the three Services. Twenty-eight questionnaires were returned providing an 80% response rate. Of the thirty-five questionnaires, fourteen were sent to U. S. Navy program managers of which twelve were returned, ten to U. S. Army program managers with all being returned, and eleven to U. S. Air Force program managers with seven being returned. Additionally, of the thirty-five questionnaires, thirteen were sent to what the Services defined as major program offices and twenty-two were sent to minor program offices.

The returned questionnaires were tabulated by questions answered just to determine if any trends were immediately noticeable [see Appendix 2]. It was found that there appeared to be a central tendency on opinion questions to move towards the answeres "moderate" or "some". When the questionnaire was originally designed, it had been hoped to overcome this central tendency by providing an even number of choices thereby precluding choosing the answer in the middle. If the questionnaire were to be used again in the future a

rewording of the choices would have to be considered.

Responses to questions 5, 6, 7, 9, 10b, d, 11 and 13 were analyzed through the use of the Kolmogorov-Smirnov test at the .01 significance level. The results of this analysis and the testing hypothesis are given in Appendix 4. The other questions were for informational purposes, and/or cross-correlation purposes and did not lend themselves to this type of analysis.

Several questions were cross-correlated. Among these were the questions on the percentage of personnel with advanced degrees [question 5] and the percentage willing to partake in formal upgrading programs [question 8 b, d]; those on frequency of obsolescence [question 6] and degree of obsolescence [question 7]; frequency of obsolescence [question 6] and value of training programs [question 9]; and degree of obsolescence [question 7] and value of training programs [question 9]; also the question on program need [question 8a] was correlated to program availability [question 10c] and degree of control [question 4]. The results of these cross correlations are in Appendix 3.

A comment sheet was provided with each questionnaire to allow the program manager to expand on his ideas of the subject. Of the twenty-eight returned questionnaires, nine respondents made use of this sheet and provided some more insight into the proposed problem.

CHAPTER IV

"Obsolescence is a problem and the degree of obsolescence is high"

The purpose of this chapter is to explore the hypothesis that technical obsolescence is a problem and that the degree of obsolescence experienced by the scientific and engineering personnel in the program office is significant. Of the twenty-seven responses received to the question "Considering all the technical personnel you have worked with or known, in your opinion what portion of them experience professional obsolescence through a long (two or more years) connection with one specific program?"

Only 7.4% felt that most of the scientific and engineering personnel experienced obsolescence. However, 77.8% felt that some technical personnel experienced obsolescence. This difference was significant at the 99% confidence level.

Of the twenty-seven responses only 3.7% felt that the degree of obsolescence was high whereas 52% felt that the degree was either low or negligible. Yet there was no significant difference in the degree of obsolescence at the 99% confidence level. It is interesting to note, however, that 37% felt that a training program was very valuable while 3.7% felt that it had no value at all. Again, no significant difference. This apparent lack of significance between the degree

of obsolescence and the value of a training program can possibly be explained in part by the wording of question 9. If it had read,

> "In your opinion, how valuable is a training program for your scientists and engineers in overcoming technical obsolescence?"

the results may have been more directly related to the matter of obsolescence. One could rationalize that obsolescence is not a problem because of the effectiveness of training programs. Yet this rationalization is not plausible when the data regarding the number of personnel who would upgrade themselves is examined. Of the twenty-eight responses to this question, 57% *felt* that less than 25% of their personnel would upgrade themselves. Added to this is the result that 57% responded that less than 25% of their personnel had advanced degrees. These two facts were significant at the 99% confidence level. This result corresponds with the findings of Landis (4:36) that there is a lack of interest in continuing education and renewal by a relatively large percentage of engineers. Thus, it appears that we have in essence a trichotomy in that:

(a) Obsolescence is not a significant problem,

(b) There is no definite group opinion on the value of training programs, and

(c) Few people participate in these upgrading programs.

What is the significance of this trichotomy? It must be realized that these questionnaires were sent out to program managers, not the engineers and scientists themselves. The perception of obsolescence between these two may be completely different. It is extremely difficult for an individual through introspection to admit that he is outdated, and it may become increasingly difficult through the psychological pressures applied in everyday living; such slogans as "don't trust anyone over thirty" and the accent on youth further inhibits the admission of obsolescence in an environment that is geared to youth and exploration of the outer fringes of the technical world. Therefore, the lack of interest in upgrading can partially be explained by the technical person's perception that he is not indeed obsolete because he is capably performing that job.

Examining the results of the questionnaire, it would appear that there really is no problem; i.e., obsolescence is not significant; therefore, it should not matter whether the technical personnel upgrade themselves in a training program. The indications of studies and theses would, however, dispel this notion. Obsolescence is a problem and it is occurring at earlier points in the careers of technical personnel. Dalton and Thompson's recent study (5) of 2500 design and development engineers points out that the engineer's performance peaks in his middle to late 30's, as measured by supervisory per-

formance appraisal. They also identified a trend toward even earlier obsolescence. The clear indication is not that a problem does not exist but rather that the severity of the problem is increasing.

The argument could be raised that formal upgrading is not required because job content will allow the individual to learn and maintain currency. In view of the responses received, however, the validity of this argument is dubious. Ninety percent of the respondees felt that the job itself as a sufficient means of maintaining technical proficiency had moderate to low value.

The ability to cope with the problem of obsolescence is limited by our perception of the problem. Unlike previous studies which have indicated that it is a significant problem, the results of this study indicate that program managers do not feel that obsolescence is a significant problem.

CHAPTER V

"Training Programs are Being Pursued by the Services to Upgrade Personnel"

The purpose of this chapter is to explore the hypothesis that training programs are being pursued by the Services to upgrade their scientific and engineering personnel.

Prior to exploring the establishment of training programs, it would be proper to explore the need for them. Of the twenty-eight respondents, twenty or 71% felt that there should be a program for the professional development of their scientists and engineers. Of the eight who felt there should not be a program, five gave as a reason for not having a program that their program office was undermanned and they could not afford the time off the job to allow an individual to upgrade. Undermanning was also mentioned by several respondents who did feel that there was a need for the program as being a handicap to the successful accomplishment of a training program. Of the twenty who felt a program was necessary only six (30%) favored a Service-sponsored full-time school and only five (25%) were in favor of a program office-sponsored program, once again indicating that undermanning is a problem. Personnel cannot be spared on a full-time basis away from the SPO nor can resources be devoted within the SPO to staff an internal training program.

Coincidentally twenty-one respondents indicated that there was a formal training program at their installation in which their scientists and engineers participated, including five of the respondents who felt there was no need for a program. This would indicate that program availability for those who felt no need was not a factor in their decision, but that rather the pressures associated with carrying out the mission were a more important factor.

The types of programs available were rather widespread with long-term service schools over a year or longer in duration being reported by only four respondents. These respondents were equally distributed among the Army and the Navy, with no indication of such a program by the Air Force respondees. The types of programs available and the number of respondees indicating that type of program are shown in Appendix I. That programs are available in sufficient quantity and variety does not appear to be an issue and the hypothesis is supported. However, as pointed out in the previous chapter, there is a lag between availability and utilization. Sixty percent of the respondents who said programs were available indicated that less than 25% of their personnel were utilizing these programs. One factor that may influence the utilization of these programs is the criteria used to select the person to attend. The most frequent criteria given was that the training must be related to the job but need not necessarily be directly

applicable to it. Although further study into the question as regards the meaning of related would be required, some inferences can be drawn. If the training must be job related, are we then indeed allowing our scientific and engineering personnel to upgrade themselves and prevent obsolescence when the program, and concurrently the job, are disbanded? It would appear that we must strive to allow our scientific and engineering personnel to pursue non-job related training objectives if they are indeed to be fruitful contributors to the next generation of systems to be acquired. For example, should the person working on an infrared seeker for a missile take a course in infrared theory or should he be taking courses in laser technology which appears to be the key to the next generation of weaponry?

It was felt by the author that perhaps there was an informal method of upgrading the individual that had greater impact than a formal program on prevention of obsolescence. The results of the survey indicate that of the three asked about: on the job training, job rotation, and professional contact [see Appendix I], that job rotation is not an employed method of informal training. Twenty-two respondents of the twenty-eight indicated they never used it and the remaining indicated job rotation at periods greater than one year and one commented on assignment rotation of three to four years as normal job rotation. So it could safely be concluded that job rotation is not

used. On-the-job training as defined by the job being sufficiently challenging so that the individual will learn and maintain currency through job contact has been discussed previously and was primarily felt to provide moderate gains in maintaining proficiency. The third method - professional contact - fell into what appeared to be a normal distribution (i.e., eight respondents felt it was high, seven felt it was low and the remainder said it was moderate).

These results appear inconclusive as far as making a statement about the value of professional to professional contact. The statement can be made, however, that contact does occur and when tied in with the question of formal training methods wherein thirteen of twenty-one respondents (62%) had formal seminars and professional society meetings, it would appear that this may be the most accepted method of preventing technical obsolescence. Further study would have to be done to determine if knowledge is gained by these sessions, and secondly whether it is retained, or are professional society meetings treated as a night out with the boys and used for personal politicing.

CHAPTER VI

Other Findings

The only significant finding of this research other than those set out in the purpose was the notion of technical management. Several program managers in their comments sections referred to their technical personnel as performing work as technical managers as opposed to performing straight technical functions (i.e., performing calculations, doing research, etc.). This in itself is not a startling find when we consider that most government technical functions are related to monitoring contractor efforts and thus the connotation of technical manager is a natural fall out of this. The finding of significance was that the program managers who discussed this felt that technical management was actually enhanced rather than obsoleted.

The implication of this finding towards the non-support of the first hypothesis, that obsolescence is a problem, although not verifiable through this study, could be that obsolescence was not perceived to be a problem because our technical personnel do not function as pure scientists and engineers but rather as engineering or technical managers, thereby not requiring the depth of technical knowledge within their field of speciality. Since the government technical manager is in essence backed up by a large staff of contractor engineers and

scientists, a broad but shallower depth of knowledge may be required to effectively manage his program rather than the narrow but deep degree of knowledge required by the purist.

CHAPTER VII

Summary and Conclusions

This exploratory effort to determine whether obsolescence is a problem within DoD programs, and if so, are we taking steps to counter it? although not conclusive has pointed out some interesting trends. The major hypothesis that obsolescence is a problem was not supported by the data. The secondary hypothesis that formal programs are in existence to combat obsolescence was supported.

One could be led to conclude from the data that obsolescence is not a problem because we train people to overcome it. However, when one looks at the low percentage of engineers and scientists who do or who would participate in such programs, the evidence belies this conclusion. Further study is needed to determine if there is a cause and effect type of relationship between availability of training programs and obsolescence prevention.

The central tendency aspect of the answers to the obsolescence question [question 6] leads the author to conclude that a definition of obsolescence and a measure of it should have been provided with the questionnaire. Further thought on this subject indicates at least two categories of technical obsolescence:

Professional obsolescence - where technical knowledge of the individual's area of specialization does not include the state of the art knowledge and techniques.

Job obsolescence - where the individual's knowledge is not sufficient to perform the current tasks assigned to him.

The author was primarily interested in the degree of professional obsolescence but believes his received answers were probably given in regard to job obsolescence although this is not verifiable from the data received. Additionally, without a measure of obsolescence, it would be difficult for the respondee to answer the question on degree of obsolescnece [question 7]. Further study could be performed in the area of obsolescence investigation by asking additional questions on both types of obsolescence and measuring the degree of obsolescence against a provided standard. Dalton and Thompson (5) have essentially measured job obsolescence rather than professional obsolescence, whereas Zelikoff's (3:14) study using curriculum changes tried to measure professional obsolescence. Zelikoff's method, however, does not consider any upgrading by the individual either through formal or informal methods. An area for further study would be the investigation of methods for measuring the degree of professional obsolescence.

Another area for further study, and this would have to be a long-term effort beyond the bounds of the Defense Systems Management

School ISP time frame, would be by using a control group of DoD program engineers and scientists, measure their performance as they go from program to program and determine if they experience job obsolescence as they move and if it is directly attributable to professional obsolescence as a result of their last assignment.

In summary, the results of this study are in essence inconclusive from a statistical viewpoint but as any exploratory effort should, it has generated areas for further in-depth study that could lead to conclusive results. If obsolescence is a significant problem, we in DoD must recognize it and take measures to prevent or circumvent it. Perhaps one solution could be retraining of personnel on a full-time basis between assignment to programs. With cutbacks in manpower occurring throughout DoD, we can ill afford to let those we retain become obsolete. The key can be found in a statement made by the late Charles M. Schwab of steel company fame:

> "You can take away my buildings, equipment and mills, but leave me my men and I will build another great steel company." (6:4)

Planning for the future is the guideline. This creative talent must be retained, even at a temporary monetary loss, if growth is to be assured. Schwab's basic statement is even more appropo when applied to the primary business of defense; meeting a future threat.

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Appendix 1

Cover Letter and Questionnaire

DEPARTMENT OF DEFENSE
DEFENSE SYSTEMS MANAGEMENT SCHOOL
FORT BELVOIR, VIRGINIA 22060

DSMS-PMC

Dear Sir:

I am conducting a survey of major program offices within DOD as an independent study project for the Defense Systems Management School at Fort Belvoir, Virginia. The nature of the study is two-fold:

(1) To determine if scientific and engineering personnel experience obsolescence when supporting a specific, long-term project; and

(2) To determine if formal and/or informal programs exist to develop and maintain technical expertise of scientists and engineers.

Please take a few moments to answer the attached questionnaire and return it in the return-addressed reply envelope.

You answers are important to the accuracy of our survey. Of course, all replies are confidential and no identification will be made with your project/ program office.

As with all standard questionnaires, they may not fully cover the respondent's point of view. I have included a blank page for your further comment. If felt necessary, please feel free to use the space provided.

A rapid reply would be greatly appreciated, since I am under a tight academic schedule at the School.

Thank you for your help.

Sincerely,

Albert A. LoSchiavo

1 Inclosure
as stated

ALBERT A. LoSCHIAVO
Major, US Air Force

PERSONNEL DEVELOPMENT QUESTIONNAIRE

1. What Government Department/Service controls your program/project office? (Circle your answer)

a. USA b. USN c. USAF d. DOD e. Other

2. In what stage of the acquisition life cycle is your program/project? (Circle your answer)

a. Conceptual
b. Validation
c. Full-Scale Development
d. Production

Comments:

3. How many scientific and engineering personnel support your program/project as a primary duty? (Circle your answer)

a. 0-10 b. 11-20 c. 21-30 d. 31-40 e. More than 40

Comments:

4. Approximately what percentage of these scientific and engineering personnel are under your program's administrative control? (Circle your answer)

a. 0-25% b. 26-50% c. 51-75% d. 76-100%

Comments:

5. Approximately what percentage of these scientific and engineering personnel possess advanced degrees in science, engineering and/or management? (Circle your answer)

a. 0-25% b. 26-50% c. 51-75% d. 76-100%

Comments:

6. Considering all the technical personnel you have worked with or known, in your opinion what portion of them experience professional obsolesence through a long (two or more years) connection with one specific program? (Circle your answer)

a. All b. Most c. Some d. None

Comments:

7. In your opinion, what is the degree of professional obsolesence of those personnel? (Circle your answer)

a. High b. Moderate c. Low d. Negligible

Comments:

8. (a) In your opinion, should there be a program for the professional development of your scientists and engineers? (Circle your answer)

a. Yes b. No

(b) If you answered NO, why not? (Circle as many as appropriate)

(1) Program Office is undermanned.
(2) Program Office has just been formed.
(3) The Program technology is state-of-the-art.
(4) My scientists and engineers should do this on their own.
(5) It takes them away from the office too much of the time.
(6) Other (Please specify) _____
_____.

(c) If you answered YES, what is the way in which it should be handled? (Circle as many as appropriate)

(1) Service-sponsored full-time school.
(2) Base-sponsored program.
(3) Program office-sponsored program.
(4) Functional organization-sponsored program.
(5) Other (Please specify) _____
_____.

Comments:

9. In your opinion, how valuable is a formal training program for your scientists and engineers? (Circle your answer)

a. Very b. Moderate c. Little d. None

Comments:

10. (a) Is there a formal training program at your installation in which your scientists and engineers can particpate? (Circle your answer)

1. Yes 2. No

(b) If you answered NO, what percentage of your personnel do you feel would participate in a formal development program if it were made accessible to them? (Circle your answer)

1. 0-25% 2. 26-50% 3. 51-75% 4. 76-100%

(c) If you answered YES, what type of program is it? (Circle as many as appropriate)

1. Off duty courses.
2. On duty courses
3. Service schools (longer than one year).
4. Formal Seminars.
5. Professional society meetings.
6. On-the-job training
7. Management development training.
8. Specialized training (in-house).
9. Other (Please specify)._____

_____

(d) If you answered YES, approximately what percentage of your scientists and engineers participate? (Circle your answer)

1. 0-25% 2. 26-50% 3. 51-75% 4. 76-100%

(e) If you answered YES, what selection criteria are used for sending your personnel to formal training ? (Circle as many as appropriate)

1. Training must be directly applicable to the job.
2. Training must be related to the job, but not directly applicable.
3. Training must be beneficial to the individual, although unrelated to the job.
4. Individual must have promotion potential.
5. The most available individual in the organization.
6. Age of the individual.
7. Other (Please specify) _____

_____

Although formal academic programs generally provide the most structured educational programs, it is recognized that often informal or semi-formal programs can provide the best interchange of knowledge. Given the definitions below, please answer the remaining questions.

On-the-job-training	Training received as a function of routinely carrying out assigned tasks and duties. The job is sufficiently challenging that the individual will learn and maintain currency through the job content.
Job rotation	Moving personnel from one job to another as a method of providing cross-fertilization of information.
Professional contact	Attending local area meetings of professional societies and/or conversing with personnel from their functional organization to keep abreast of changes in their field.

11. To what degree do you feel that on-the-job training is sufficient to maintain the technical proficiency of your scientists and engineers? (Circle your answer)

a. High b. Moderate c. Low d. None

Comments:

12. How often do you rotate your scientists and engineers in jobs as a training method? (Circle your answer)

a. Never b. 0-6 months c. 7-12 months d. 12 months or more

Comments:

13. To what degree is there outside professional-to-professional contact among your scientists and engineers and other personnel working in the same field? (Circle your ansqwer)

a. High b. Moderate c. Low d. None

Comments:

14. Please add other comments you may have:

APPENDIX 2

Tabulation of Answers

Question	Responses to Answer Choices				
1)	a. USA	b. USN	c. USAF	d. DoD	e. Other
	10	12	7	1	0

2)	Conceptual	5
	Validation	10
	Full Scale Development	15
	Production	15

Note: Some respondents, such as basket programs checked several phases.

3)	a. 0-10	b. 11-20	c. 21-30	d. 31-40	e. More than 40
	2	8	6	2	10

4)	a. 0-25%	b. 26-50%	c. 51-75%	d. 76-100%
	10	5	6	7

5)	a. 0-25%	b. 26-50%	c. 51-75%	d. 76-100%
	16	5	6	1

6)	a. All	b. Most	c. Some	d. None
	0	2	21	4

7)	a. High	b. Moderate	c. Low	d. Negligible
	1	10	10	5

8(a)	a. Yes	b. No
	20	8

(b)	(1) Program Office is undermanned	2
	(2) Program Office has just been formed	1
	(3) The program technology is state-of-the-art	5
	(4) My scientists and engineers should do this on their own	7
	(5) It takes them away from the office too much	4
	(6) Other (please specify)	1

8(c)	(1) Service-sponsored full time school	6
	(2) Base-sponsored program	11
	(3) Program office-sponsored program	5
	(4) Functional organization-sponsored program	8
	(5) Other (Please specify)	3

9) a. Very 11 b. Moderate 9 c. Little 6 d. None 1

10(a) a. Yes 20 b. No 8

(b) 1. 0-25% 5 2. 26-50% 2 3. 51-75% 1 4. 76-100%

(c)	1. Off duty courses	15
	2. On duty courses	16
	3. Service Schools (longer than one year)	4
	4. Formal Seminars	13
	5. Professional society meetings	13
	6. On-the-job training	10
	7. Management development training	11
	8. Specialized training (in-house)	10
	9. Other (Please specify)	0

(d) 1. 0-25% 12 2. 26-50% 6 3. 51-75% 1 4. 76-100% 1

(e)	1. Training must be directly applicable to the job.	5
	2. Training must be related to the job, but not directly applicable.	19
	3. Training must be beneficial to the individual, although unrelated to the job.	6
	4. Individual must have promotion potential.	7
	5. The most available individual in the organization.	3
	6. Age of the individual.	1
	7. Other (Please specify)	3

Note: Other in all cases was desire of the individual.

11.	a. High	b. Moderate	c. Low	d. None
	3	16	9	0

12.	a. Never	b. 0-6 mos.	c. 7-12 mos.	d. 12 mos. or more - 6
	22	0	0	

13.	a. High	b. Moderate	c. Low	d. None
	8	13	7	0

Appendix 3

Question Cross Correlation

Question 5
Per cent with Advanced Degree

Question 10 b. d % willing to upgrade formally	0-25	26-50	51-75	76-100	Totals	%
76-100	1	1			2	7.1
51-75	1		1		2	7.1
26-50	3	3	2		8	28.7
0-25	11	1	3	1	16	57.1
Totals	16	5	6	1	28	
%	57.1	17.9	21.4	3.6		

Question 6
Frequency of Obsolescence

Question 9
Value of Training Program

	All	Most	Some	None	Totals	
Very		1	7	2	10	37%
Moderate		1	9	1	11	40.7%
Little			4	1	5	18.6%
None			1		1	3.7%
Totals		2	21	4	27	
		7.4%	77.8%	14.8%		

Question 6
Frequency of Obsolescence

Question 5
Degree of Obsolescence

	All	Most	Some	None	Totals	
Hi		1			1	3.7%
Mod		1	11		12	44.4%
Lo			9		9	33.3%
Neg			1	4	5	18.6%
Totals		2	21	4	27	
		7.4%	77.8%	14.8%		

Question 5

Degree of Obsolescence

Question 9

Value of Training Program

	Hi	Mod	Lo	Neg	Totals	
Very	1	4	3	2	10	37%
Mod		5	5	1	11	40.7%
Little		3		2	5	18.6%
None			1		1	3.7%
Totals	1	12	9	5	27	
	3.7%	44.4%	33.3%	18.6%		

Question 4

Question 8b Program Need	Degree of Control (%) 0-25	26-50	51-75	76-100	Totals	%
Yes	7	3	4	6	20	71
No	3	2	2	1	8	29
Totals	10	5	6	7	28	
%	36	18	21	25		

Question 10a

Question 8a Program Need	Program Availability Yes	No
Yes	16	4
No	5	3

Appendix 4

Kolmogorov-Smirnov Test
(.01 Significance Level)
Results

Question	Accept H_o	Reject H_o
5		x
6		x
7	x	
9	x	
10 b, d		x
11	x	
13	x	

The Null hypothesis (H_o) is that there is no significant identifiable group opinion; i.e., that responses will be distributed evenly across all choices.

The hypothesis of test (H_1) is that there is a significant difference in choices (a group opinion) at the 99% confidence level.

Example Calculation

Question 5

	0-25	26-50	51-75	76-100
Cum Resp	16	21	27	28
$S_{28}(x)$	.57	.75	.96	1.00
$F_o(x)$	.25	.50	.75	1.00
d	.32	.25	.21	0
D_a	.32			

N = 28 use N = 30 α = .01 D_c = 0.29

$D_a > D_c$ therefore cannot accept H_o